

# SCIENCE

# And Technology Program



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Present groundwater flow and contaminant transport models do not address scale issues known to be critical to understanding and remediating problems associated with joint fill erosion and contaminant transport in fractured or jointed rock masses.

A growing number of engineers and geologists have recently begun characterizing fractured and jointed rock masses as fractal shapes. This procedure uses the fractal dimension to describe the statistical chance associated with both rock mass regularities and irregularities. Computer simulation of fractal characterized rock masses exhibits global and local fracture and joint characteristics at very small to very large scales. This simulation permits a unique method for modeling water flow and contaminant transport and will enhance understanding of groundwater flow, erosion of joint fill, and contaminant transport in rock masses. Fractal models will also permit small scale effects associated with contaminant transport and remediation schemes to be numerically separated and studied. The applicability of numerical modeling can easily be verified by comparison with controlled laboratory tests and real field measurements obtained from literature.

The objective of the project is to develop and test groundwater and contaminant transport modeling methodologies. The developed model will improve the state-of-the-art by incorporating recent developments in soil and rock characterization techniques that use fractal geometry to describe scaling relations. Model tests will validate the usefulness of the method.

A literature search and review were conducted to ascertain the state-of-the-art related to the use of fractal geometry in subsurface characterization and groundwater and contaminant transport modeling. A draft state-of-the-art report titled, "Fractals and Flow through Porous Media," has been prepared. This report will be finalized in FY 2000.

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